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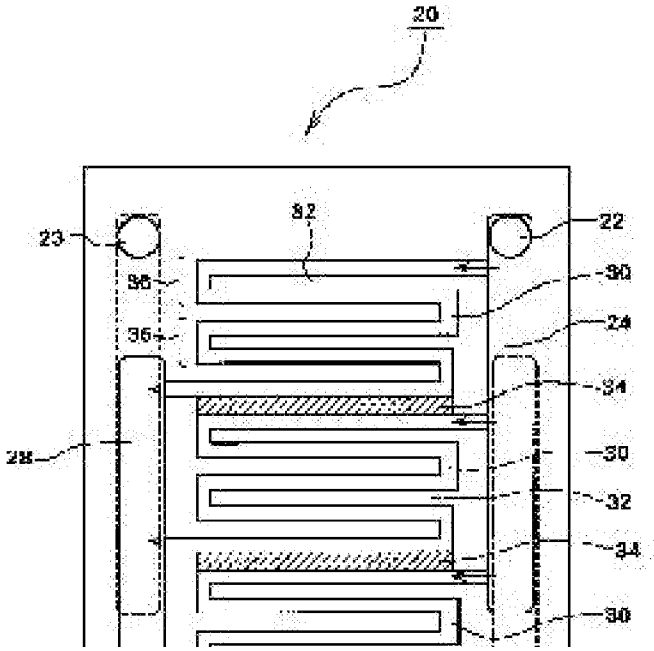
(54) FUEL CELL AND SEPARATOR FOR FUEL CELL

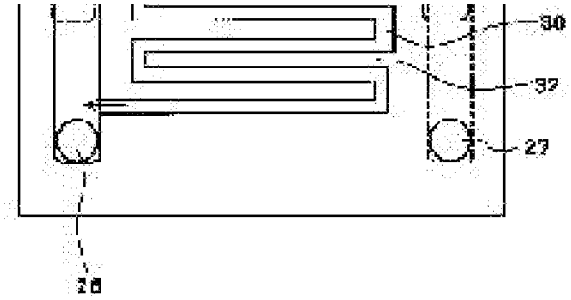
(57)Abstract:

PROBLEM TO BE SOLVED: To more equally supply fuel gas or oxidizing gas to a gas diffusion electrode.

SOLUTION: Three independent zigzag passage grooves 30 acting as a passage of fuel gas or oxidizing gas are formed on the stacking surface of a separator 20, and projecting ribs 34 projecting than other ribs 32 from the stacking surface of the separator 20 are formed in a portion forming a boundary between adjacent two passages, that is, a portion separating the upstream part of one passage from the downstream part of the other passage. Since the width in the stacking direction of the gas diffusion electrode is narrowed by the projecting rib 34, the short path of the fuel gas or the oxidizing gas from the upstream part of one passage to the downstream part of the



other passage through the gas diffusion electrode can be prevented. As a result, the fuel gas or the oxidizing gas can equally be supplied to the gas diffusion electrode.



* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]A deformable gas diffusion electrode which **** an electrolyte membrane.
A separator which makes a septum between unit cells when a passage groove which supplies fuel gas or oxidizing gas to this gas diffusion electrode was formed, it laminates with this gas diffusion electrode and a fuel cell stack is formed.
It is the fuel cell provided with the above, at least a part of rib between said passage grooves was projected from a lamination side of said separator, and width of a laminating direction in a part in contact with a rib to which said gas diffusion electrode this projected was narrowed.

[Claim 2]A fuel cell, wherein were the fuel cell according to claim 1, and it was bottom two or more channels where said passage groove is mutually-independent, and a downstream of a channel contiguous to an upstream part of a channel and this channel adjoined, and was formed and said projected rib is formed in a part which separates said upstream part and said downstream.
[Claim 3]A fuel cell, wherein a clinch part to which it is the fuel cell according to claim 1 or 2, and said passage groove changes the flow direction of said fuel gas or oxidizing gas was formed and said projected rib is formed in a part which separates the upstream and the downstream from said clinch part.
[Claim 4]A passage groove which supplies fuel gas or oxidizing gas to a gas diffusion electrode formed of a deformable member is formed, A separator for fuel cells which is a separator for fuel cells which makes a septum between unit cells when it laminates with this gas diffusion electrode and a fuel cell stack is formed, and is characterized by making at least a part of rib between said passage grooves project from a lamination side of said separator.
[Claim 5]Are the separator for fuel cells according to claim 4, and said passage groove, A separator for fuel cells, wherein it was bottom two or more mutually-independent channels, and a downstream of a channel contiguous to an upstream part of said channel and this channel adjoined, and was formed and said projected rib is formed in a part which separates said upstream part and said downstream.
[Claim 6]Are the separator for fuel cells according to claim 4 or 5, and said passage groove, A separator for fuel cells, wherein a clinch part to which the flow direction of said fuel gas or oxidizing gas is changed was formed and said projected rib is formed in a part which separates the upstream and the downstream from said clinch part.
[Claim 7]A fuel cell with which it is a fuel cell characterized by comprising the following, and said gas diffusion electrode makes smaller than other parts at least some gas permeation nature of a part where

said rib contacts.
A unit cell which pinched an electrolyte membrane with a gas diffusion electrode, and was formed.
A separator which makes a septum between unit cells when a rib which forms a channel of fuel gas or oxidizing gas in contact with this gas diffusion electrode was formed, it laminates with this unit cell and a fuel cell stack is formed.

[Claim 8]Are the fuel cell according to claim 7, and said channel, A fuel cell which are bottom two or more mutually-independent channels, and is a part where a rib which was formed so that an upstream part of a channel of 1 and a downstream of other channels might adjoin, and was formed in a part from which at least a part of part where said rib contacts separates said upstream part and said downstream contacts.
[Claim 9]Are the fuel cell according to claim 7 or 8, and said channel, A fuel cell which is a part where a rib which a clinch part to which the flow direction of said fuel gas or said oxidizing gas is changed was formed, and was formed in a part from which at least a part of part where said rib contacts separates the upper stream and the lower stream of said clinch part contacts.
[Claim 10]A fuel cell which claims 7 thru/or 9 are the fuel cells of a statement either, and is the rib which projected a rib which contacts a part which made said gas permeation nature small to a laminating direction rather than other ribs.
[Claim 11]A fuel cell which claims 7 thru/or 10 are the fuel cells of a statement either, and is the rib by which a rib which contacts a part which made said gas permeation nature small was formed in wide rather than other ribs.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention about the separator for a fuel cell and fuel cells in detail, The deformable gas diffusion electrode which **** an electrolyte membrane, By the fuel cell and the deformable member which have a separator which makes the septum between unit cells when the passage groove which supplies fuel gas or oxidizing gas to this gas diffusion electrode was formed, it laminates with this gas diffusion electrode and a fuel cell stack is formed. When the passage groove which supplies fuel gas or oxidizing gas to the formed gas diffusion electrode was formed, it laminates with this gas diffusion electrode and a fuel cell stack is formed, it is related with the separator for fuel cells which makes the septum between unit cells.
[0002]
[Description of the Prior Art]The gas diffusion electrode which **** an electrolyte membrane as this kind of a fuel cell conventionally, The independent passage groove of the plurality which supplies fuel gas or oxidizing gas to a gas diffusion electrode is formed, and that by which the separator with which the rib between passage grooves covered the whole surface, and was formed in uniform height was laminated is proposed (for example, JP,7-263003,A etc.). In this fuel cell, it is supposed that fuel gas and oxidizing gas can be uniformly supplied to the whole gas diffusion electrode, and battery capacity can be demonstrated by passing fuel gas and oxidizing gas to the gas passageway formed with two or more independent passage grooves and gas diffusion electrodes.
[0003]
[Problem(s) to be Solved by the Invention]However, in such a fuel cell, the short pass of flowing into the gas passageway which adjoins via a gas diffusion electrode without fuel gas and oxidizing gas passing along the usual gas passageway may arise. The gas diffusion electrode is formed in the laminating direction with predetermined width of a carbon mesh etc., in order to secure the flexibility of diffusion of fuel gas and oxidizing gas which were supplied. The rib between the passage grooves which covered the whole surface and were formed in uniform height in the fuel cell using the conventional separator contacts a gas diffusion electrode, Since it laminates so that the width of the laminating direction of a gas diffusion electrode may continue all over a lamination side and may become almost fixed, in the part which the pressure differential has produced between adjoining channels. Fuel gas and oxidizing gas flowed into the channel which adjoins via a gas diffusion electrode, and the problem that fuel gas and oxidizing gas seldom flowed into some gas passagewaies had arisen. Since this checks the

equivalent supply to the gas diffusion electrode of fuel gas or oxidizing gas, it will become impossible to fully demonstrate the performance of a fuel cell.

[0004]The fuel cell of this invention is made into one thing of the purpose for which fuel gas and oxidizing gas are supplied more to homogeneity at a gas diffusion electrode, and performance is fully demonstrated.

[0005]The separator for fuel cells of this invention is made into one thing of the purpose for which fuel gas and oxidizing gas are supplied more to a gas diffusion electrode at homogeneity.

[0006]

[The means for solving a technical problem, and its operation and effect] The separator for a fuel cell and fuel cells of this invention took the following means, in order to attain at least a part of above-mentioned purpose.

[0007]The deformable gas diffusion electrode in which the 1st fuel cell of this invention **** an electrolyte membrane, It is a fuel cell which has a separator which makes the septum between unit cells when the passage groove which supplies fuel gas or oxidizing gas to this gas diffusion electrode was formed, it laminates with this gas diffusion electrode and a fuel cell stack is formed, At least a part of rib between said passage grooves was projected from the lamination side of said separator, and the width of the laminating direction in the part in contact with the rib to which said gas diffusion electrode this projected was narrowed.

[0008]In the 1st fuel cell of this this invention, at least a part of rib between passage grooves is projected from the lamination side of a separator, Since the width of the laminating direction in the part in contact with the projected rib is narrowed, the gas diffusion electrode can lessen more generating of the short pass of fuel gas or oxidizing gas in the part in contact with the projected rib. As a result, fuel gas and oxidizing gas can be more nearly uniformly supplied to a gas diffusion electrode.

[0009]In the 1st fuel cell of such this invention, it is bottom two or more channels where said passage groove is mutually-independent, and the downstream of the channel contiguous to the upstream part of a channel and this channel adjoins, and is formed, and it is preferred for said projected rib to make it form in the part which separates said upstream part and said downstream. If it carries out like this, it can lessen more that fuel gas and oxidizing gas carry out a short pass to the downstream of the channel where the low-tension side adjoins from the upstream part of the channel of the high-tension side.

[0010]In the 1st fuel cell of this invention, a clinch part to which said passage groove changes the flow direction of said fuel gas or oxidizing gas is formed, and it is preferred for said projected rib to make it form in a part which separates the upstream and the downstream from said clinch part. If it carries out like this, generating of fuel gas from a channel to a channel of the downstream of the upstream from a clinch part or a short pass of oxidizing gas can be lessened more.

[0011]A passage groove which supplies fuel gas or oxidizing gas to a gas diffusion electrode formed of a member with a deformable separator for fuel cells of this invention is formed, When it laminates with this gas diffusion electrode and a fuel cell stack is formed, it is a separator for fuel cells which makes a septum between unit cells, and at least a part of rib between said passage grooves was made to project from a lamination side of said separator.

[0012]Since at least a part of rib of a passage groove is made to project from a lamination side of a separator and it is formed in a separator for fuel cells of this this invention, In a part which contacts a projected rib when it laminates with a gas diffusion electrode, generating of a short pass of fuel gas or oxidizing gas can be lessened more. As a result, fuel gas and oxidizing gas can be more nearly uniformly

supplied to a gas diffusion electrode.
[0013]In a separator for fuel cells of such this invention, said passage groove, It is bottom two or more mutually-independent channels, and a downstream of a channel contiguous to an upstream part of said channel and this channel adjoins, and is formed, and it is preferred for said projected rib to have been formed in a part which separates said upstream part and said downstream. If it carries out like this, it can lessen more that fuel gas and oxidizing gas carry out a short pass to the downstream of a channel where the low-tension side adjoins from the upstream of a channel of the high-tension side.
[0014]In a separator for fuel cells of this invention, a clinch part to which said passage groove changes the flow direction of said fuel gas or oxidizing gas is formed, and it is preferred for said projected rib to have been formed in a part which separates the upstream and the downstream from said clinch part. If it carries out like this, generating of fuel gas from the upstream from a clinch part to a channel of the downstream or a short pass of oxidizing gas can be lessened more.
[0015]A unit cell which the 2nd fuel cell of this invention pinched an electrolyte membrane with a gas diffusion electrode, and was formed, It is a fuel cell which has a separator which makes a septum between unit cells when a rib which forms a channel of fuel gas or oxidizing gas in contact with this gas diffusion electrode was formed, it laminates with this unit cell and a fuel cell stack is formed, Said gas diffusion electrode makes smaller than other ribs at least a part of gas permeability of a part where said rib contacts, and let things be gists.
[0016]In the 2nd fuel cell of this this invention, generating of a short pass between adjoining channels can be controlled by adjusting gas permeability of a gas diffusion electrode. As a result, fuel gas and oxidizing gas can be more nearly uniformly supplied to a gas diffusion electrode.
[0017]In the 2nd fuel cell of such this invention, said channel, It shall be bottom two or more mutually-independent channels, and at least a part of part where it is formed in so that an upstream part of a channel of 1 and a downstream of other channels may adjoin, and said rib contacts shall be a part where a rib formed in a part which separates said upstream part and said downstream contacts. If it carries out like this, it can lessen more that fuel gas and oxidizing gas carry out the short pass of the gas permeability with a gas diffusion electrode made low to the downstream of a channel where the low-tension side adjoins from the upstream of a channel of the high-tension side.
[0018]In the 2nd fuel cell of this invention, said channel, At least a part of part where a clinch part to which the flow direction of said fuel gas or oxidizing gas is changed is formed, and said rib contacts shall be a part where a rib formed in a part which separates the upper stream and the lower stream of said clinch part contacts. With a gas diffusion electrode which made gas permeability low, it can lessen more that fuel gas and oxidizing gas carry out a short pass from the upstream from a clinch part to the downstream.
[0019]In the 2nd fuel cell of this invention, a rib which contacts a part which made small gas permeation nature of said gas diffusion electrode shall be a rib projected to a laminating direction rather than other ribs.
[0020]In the 2nd fuel cell of this invention, a rib which contacts a part which made small gas permeation nature of said gas diffusion electrode shall be a rib formed in wide rather than other ribs.
[0021]
[Embodiment of the Invention]Next, an embodiment of the invention is described using an example. Drawing 1 is a lineblock diagram showing the outline of the composition of the unit cell of the fuel cell 10 which is one example of this invention. The fuel gas which **** the electrolyte membrane 12 so that

the fuel cell 10 of an example may be illustrated. (For example, hydeogen-rich gas containing hydrogen, etc.) The near gas diffusion electrode 14 and the gas diffusion electrode 16 by the side of oxidizing gas (for example, air containing oxygen, etc.), The unit cell provided with the separator 20 with which the passage groove 30 which forms the channel for supplying fuel gas and oxidizing gas, respectively was formed is laminated and constituted by the gas diffusion electrodes 14 and 16. The electrolyte membrane 12 is formed of the membrane formed with solid polymer materials, such as fluororesin which presents good proton conductivity by a damp or wet condition.

[0022]The gas diffusion electrodes 14 and 16 are formed by the carbon crossing which the catalyst of the alloy which consists of a deformable porous conductive member, for example, platinum, or platinum, and other metal scoured, and was loaded with it.

[0023]The separator 20 is formed with unpenetrated gas compactness carbon. Drawing 2 is a lineblock diagram showing the outline of the composition of the separator 20 for fuel cell 10 of an example. As shown in drawing 2, near the both ends of the lamination side of the separator 20, The fuel gas feed hopper 22 for supplying fuel gas to the surface of the separator 20, The fuel gas outlet 26 for discharging fuel gas from the separator 20, the oxidizing gas feed hopper 23 for supplying oxidizing gas to a rear face, and the oxidizing gas outlet 27 for discharging oxidizing gas from the separator 20 are formed. The channel for flowing or flowing out fuel gas or oxidizing gas is formed in the laminating direction of a fuel cell stack, and each of these holes are discharged by each cell of a fuel cell stack from supply or each cell, when it laminates and a fuel cell stack is formed.

[0024]The winding passage groove 30 in which the four clinch parts 36 to which the flow direction of fuel gas is changed were formed is independently formed in three drawing 2 Nakagami down, and three channels which carried out mutually-independent in the state where it laminated with the gas diffusion electrode 14 are formed in the surface of the separator 20. It is connected with the fuel gas feed hopper 22 via the fuel gas supply route 24, and these three channels are connected with the fuel gas outlet 26 via the fuel gas exhaust passage 28 at that entrance at the exit. Therefore, the fuel gas which flowed from the fuel gas feed hopper 22 will go into each channel through the fuel gas supply route 24, will flow in the shape of a winding path respectively, and will result to the fuel gas outlet 26.

[0025]The upstream part of the channel formed in the part which makes the boundary of three channels between the passage grooves 30, i.e., the center section in a figure, and the lower part, To the part which separates the downstream of the channel formed in the figure Nakagami part and center section which adjoin these channels, respectively. When the protruded ribs 34 (refer to drawing 1) of the convex configuration projected rather than the rib 32 of other parts are formed from the lamination side of the separator 20 and the separator 20 and the gas diffusion electrode 14 are laminated, The gas diffusion electrode 14 is pushed by the part in which the protruded ribs 34 were formed, and the width of a laminating direction becomes narrow. Since fuel gas is supplied to each channel where a predetermined pressure is put so that it may spread round the gas diffusion electrode 14 whole, a pressure differential produces it near an entrance (upstream part) and near an exit (downstream) a channel. For this reason, contiguity of the adjoining upstream part of one channel of a channel and downstream of the channel of another side will produce what is called a short pass [say / that gas flows into the downstream of a low pressure state through the gas diffusion electrode 14 from the upstream part of a high pressure state according to this pressure differential]. Therefore, the short pass of fuel gas can be prevented by making the resistance at the time of forming the protruded ribs 34 in this part, and fuel gas moving the gas diffusion electrode 14 increase. Preventing the fall of gas diffusion nature, the grade of projection of

these protruded ribs 34 is set up to such an extent that a short pass can be prevented. In the example, the thickness of the gas diffusion electrode 14 and the height of the portion projected rather than the rib 32 of the protruded ribs 34 were 0.3 mm and 0.2 mm, respectively. That is, the thickness (width of a laminating direction) of the gas diffusion electrode 14 in the part to which the protruded ribs 34 touch will be narrowed by abbreviated 0.1mm (other parts abbreviated 0.3mm). If the width of the laminating direction of the gas diffusion electrode 14 is narrowed with the protruded ribs 34, since the diffusibility of gas worsens, by the part, aggravation of gas diffusion nature will have been controlled by making only the center portion of a convex configuration, i.e., the contact width direction, the protruded ribs 34 project, and making contact width narrower than the rib 32. When the tip end part of the convex configuration of the protruded ribs 34 is formed of the elastic member (what has conductivity is desirable) and is laminated, it has prevented damaging the gas diffusion electrode 14.

[0026]The winding passage groove where four clinch parts to which the flow direction of oxidizing gas is changed like the surface of the separator 20 were provided also in the rear face of the separator 20 is independently formed in three figure Nakagami down, Three channels which carried out mutually-independent after the rib and the gas diffusion electrode 16 between passage grooves had contacted are formed. That is, the composition of the rear face of the separator 20 is the same as the composition of the surface of the separator 20. Therefore, since it overlaps about the composition of the rear face of the separator 20, the explanation is omitted.

[0027]Since according to the fuel cell 10 of this invention explained above the protruded ribs 34 were formed in the part (part which separates the upstream part of one channel, and the downstream of the channel of another side) which makes the boundary of an adjoining channel and width of the laminating direction of the gas diffusion electrodes 14 and 16 was narrowed, The short pass of fuel gas or oxidizing gas based on the pressure differential between channels can be lessened more. As a result, it can flow through fuel gas or oxidizing gas uniformly by the gas diffusion electrode 14 and the 16 whole, and the performance of a cell can fully be demonstrated. And since contact width of the tip end part to the gas diffusion electrodes 14 and 16 was made narrower than other ribs 32 by making shape of the protruded ribs 34 convex, the aggravation of gas diffusion nature based on narrowing width of the laminating direction of the gas diffusion electrodes 14 and 16 can be controlled. Since the tip end part of the protruded ribs 34 of a convex configuration was formed by the elastic member, the gas diffusion electrodes 14 and 16 are not damaged in the case of lamination.

[0028]Although it shall form in the part which separates the upstream part and downstream of the channel which adjoins the protruded ribs 34 in the fuel cell 10 of an example, it is good also as what is formed in the part where the flow direction of fuel gas or oxidizing gas counters protruded ribs, i.e., the part which separates the upstream and the downstream of the clinch part 36.

[0029]Although the protruded ribs 34 shall be formed in the separator 20 with which the three independent winding passage groove 30 was formed in the lamination side in the fuel cell 10 of an example, It is applicable also to the separator which forms the passage groove of all other shape for supplying fuel gas and oxidizing gas to a gas diffusion electrode. The outline of the composition of the separators 20B and 20C of a modification is shown in drawing 3 and drawing 4. The same numerals are attached about the separator 20 and identical parts of the example. In drawing 3 and drawing 4, the winding passage groove of the couple through which it flows into the lamination side of the separators 20B and 20C in parallel is independently formed in three sliding directions. At this time, by drawing 3, the protruded ribs 34 are formed in the part which separates three channels, and the part to which the

flow direction of fuel gas or oxidizing gas counters, and are formed in the part which makes further the boundary of the channel of a couple through which it flows in parallel at drawing 4. Of course, if it is a part which separates between passage grooves, it will not matter as what forms protruded ribs in what kind of part. In the separator with which the single channel (for example, one winding channel) was formed, it does not matter as what forms protruded ribs in the part (for example, part which separates the winding upstream and downstream of a clinch part of a channel) which separates between the channel.

[0030]Although the tip end part of the protruded ribs 34 of a convex configuration shall be formed by an elastic member in the fuel cell 10 of an example, it is good also as what forms the separator 20 in one with an identical material.

[0031]The fuel cell 10 of an example is available also as a thing which makes other parts and whole project, although only the center portion of the direction of a convex configuration, i.e., contact width, makes the protruded ribs 34 project.

[0032]Although the short pass of fuel gas or oxidizing gas shall be prevented in the fuel cell 10 of an example by pressing the gas diffusion electrodes 14 and 16 with the protruded ribs 34 formed in the separator 20, and making it compress, It is good also as what prevents the short pass of fuel gas or oxidizing gas by the protruded ribs 34 being alike instead, or changing the gas permeability of a gas diffusion electrode selectively with the protruded ribs 34. That is, the gas permeability of the part in which gas tends to carry out a short pass in a gas diffusion electrode is processed so that it may become lower than other parts. For example, when it constitutes a gas diffusion electrode by applying conductive powder to a porous conductive member, it depends for the gas permeability on the particle diameter and quantity of conductive powder. That is, gas permeability becomes small, so that gas permeability becomes large, so that the particle diameter of conductive powder becomes large and the quantity of conductive powder increases again, the particle diameter of conductive powder becomes small and the quantity of conductive powder decreases again. Therefore, if the particle diameter and quantity of conductive powder are adjusted, the gas permeability according to each part of the gas diffusion electrode can be adjusted. As a part which makes gas permeability of a gas diffusion electrode low, they are a part where the protruded ribs 34 should be formed in the fuel cell 10 of an example, the separators 20, 20B, and 20C of the fuel cell of the modification, etc., and a contacting part. If it carries out like this, since the same function as the protruded ribs 34 of the separator 20 of the fuel cell 10 of an example can be exhibited, the same effect as the fuel cell 10 of an example can be done so also in this modification.

[0033]Although fuel gas and oxidizing gas formed the protruded ribs 34 which made the rib of the part which is easy to carry out a short pass project rather than other ribs 32 in the fuel cell 10 of an example, or the separators 20, 20B, and 20C of the modification, It does not matter as what takes the large interval between the channels which form in wide the rib 35 of the part which is easy to carry out a short pass rather than other ribs 32, and adjoin so that it may illustrate to drawing 5. In this case, since the pressure gradient between the channels separated with the wide rib 35 can be made small, the short pass of fuel gas or oxidizing gas can be controlled. Therefore, the same effect as the fuel cell 10 of an example or the fuel cell of the modification can be done so.

[0034]In the fuel cell 10 of such an example, or the fuel cell of the modification, By the part which contacts the wide rib 35 formed in the protruded ribs 34 formed in the separators 20, 20B, and 20C, or the separator 20D in the catalyst between the gas diffusion electrodes 14 and 16 and the electrolyte membrane 12, or the part which made gas permeability low, it is good also as what is not formed. If it carries out like this, the quantity of the catalyst to be used can be reduced. Drawing 6 is a figure showing

an electrolyte membrane, a gas diffusion electrode, and an example that seems to form a catalyst selectively in between. The process of plugging up with this method first the passage groove formed in the separator using wax material so that it may illustrate is performed. This state is drawing 6 (a). Next, the process of forming an electrolyte layer (electrolyte membrane) on the separator of the state of drawing 6 (a), and (drawing 6 (c)) pinching with the separator which similarly plugged up the passage groove with wax material so that this electrolyte layer may be sandwiched (drawing 6 (d)), and removing wax material in that state is performed (drawing 6 (e)). Then, a catalyst bed is formed in the part which the electrolyte layer exposed by removal of wax material, and (drawing 6 (f)) a gas diffusion layer is formed on it (drawing 6 (g)), and it completes.

[0035]As mentioned above, although the embodiment of the invention was described using the example, of course, it can carry out with the gestalt which becomes various within limits which are not limited to such an example of this invention at all, and do not deviate from the gist of this invention.

[Translation done.]